

US EPA ARCHIVE DOCUMENT

Air Toxics in the Detroit Exposure and Aerosol Research Study

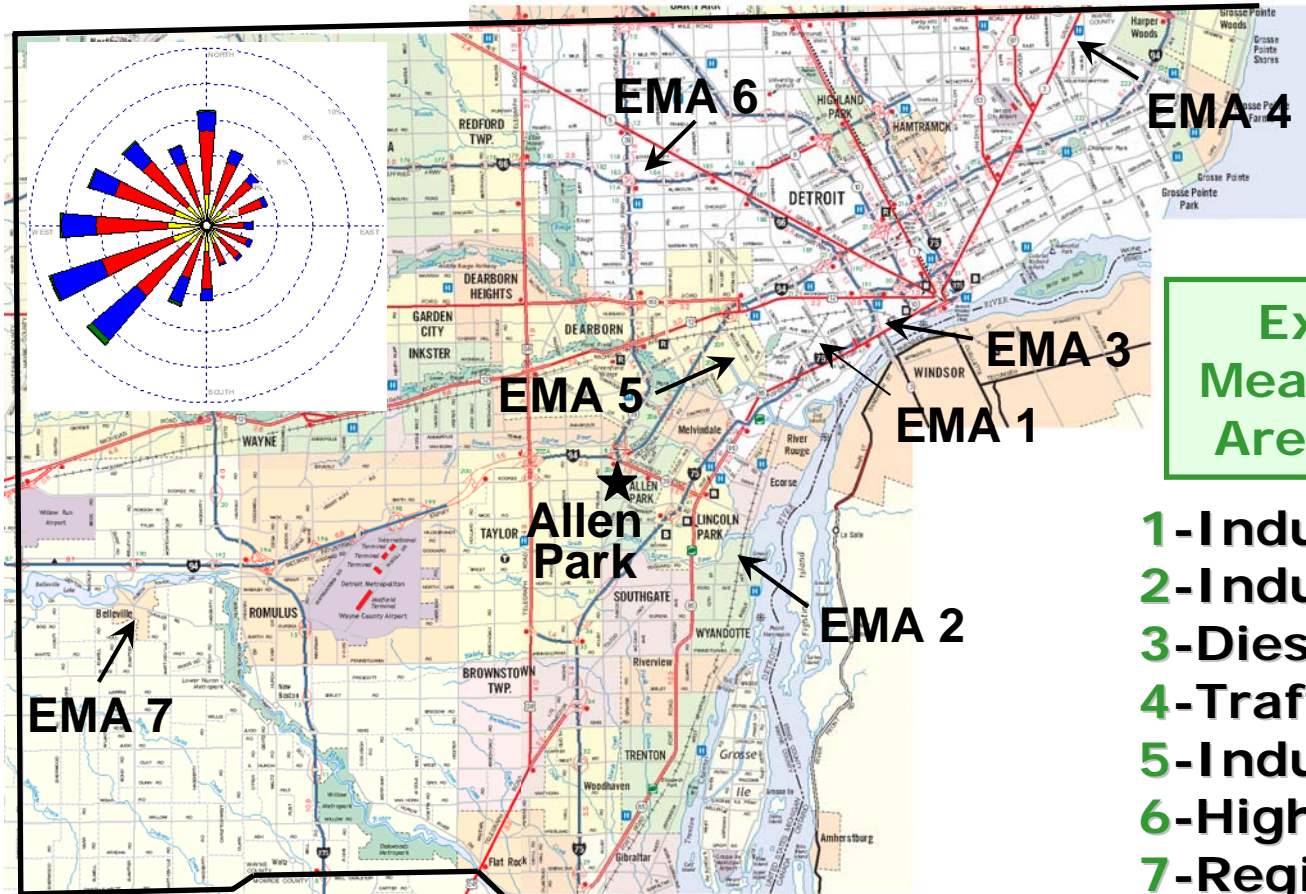
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**U.S. EPA
National Exposure Research Laboratory**

***Detroit, MI
October 24, 2007***

DEARS Study Sites

(Emphasis on Proximity to Sources)



**Exposure
Measurement
Areas (EMA)**

- 1-Industrial**
- 2-Industrial** (not monitored)
- 3-Diesel**
- 4-Traffic/ Industrial**
- 5-Industrial**
- 6-Highway**
- 7-Regional**

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DEARS Monitoring Design

- 3 year study - July '04 to Feb. '07
- ~120 homes - 5 days in winter and summer
- Concurrent monitoring
 - Personal
 - Residential indoor & outdoor
 - Ambient



DEARS Measurements

<u>Parameter</u>	<u>Personal</u>	<u>Indoor</u>	<u>Outdoor</u>	<u>Ambient</u>
PM_{2.5} (mass, elements)	X	X	X	X
PM_{coarse} (mass, elements)	--	X	X	X
EC-OC (PM _{2.5})	--	X	X	X
EC (PM _{2.5})	X	X	X	X
Nitrate	--	X	X	X
Gases (O ₃ , NO ₂ , SO ₂)	X	--	-NO ₂	X
Aldehydes	X	X	X	X
VOCs	X	X	X	X
SVOCs	--	X	X	X
PAHs	--	X	X	X
Air Exchange Rate	--	X	--	--

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Passive Samplers



- Diffusive samplers -
25 VOCs and 3
aldehydes
- Aromatics/HCs (9)
- Halogenated HCs
(16)
- Detection limits
 - VOCs ~ 50 pptv

VOCs Measured in DEARS

Aromatics/HCs

Benzene
Toluene
Ethylbenzene
m,p-Xylene
o-Xylene
1,3-Butadiene
4-Ethyltoluene
1,3,5-Trimethylbenzene
Styrene

Chlorinated Aromatics/HCs

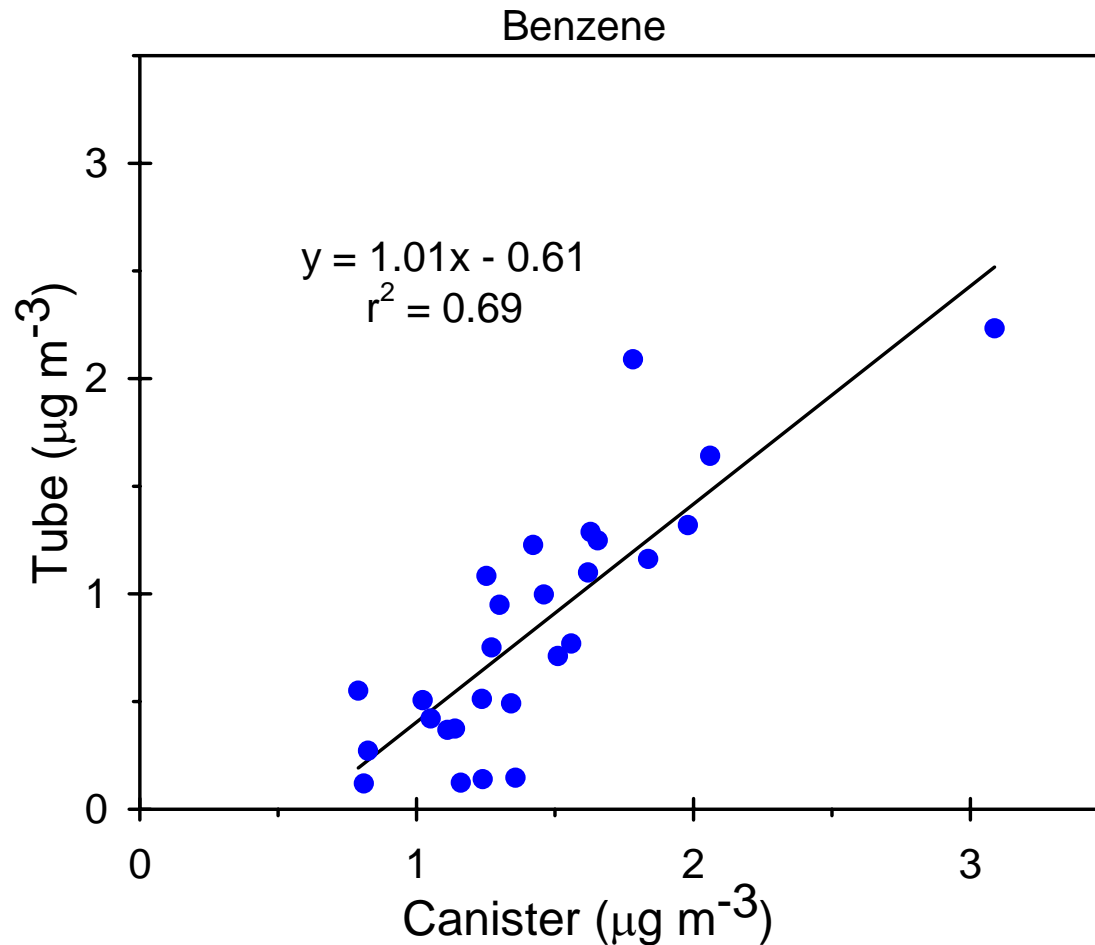
Carbon tetrachloride
1,1-Dichloroethane
1,2-Dichloroethane
1,1,1-Trichloroethane
1,1-Dichloroethylene
cis-1,2-Dichloroethylene
Trichloroethylene
Perchloroethylene
1,2-Dichloropropane
Chlorobenzene
m-Dichlorobenzene
o-Dichlorobenzene
p-Dichlorobenzene

Freon

Trichlorofluoromethane (11)
1,1,2-Trichloro-1,2,2-trifluoroethane (113)
1,2-Dichloro-1,1,2,2-tetrafluoroethane (114)

Method Comparison

Tube and Canister



Preliminary results – Winter '06

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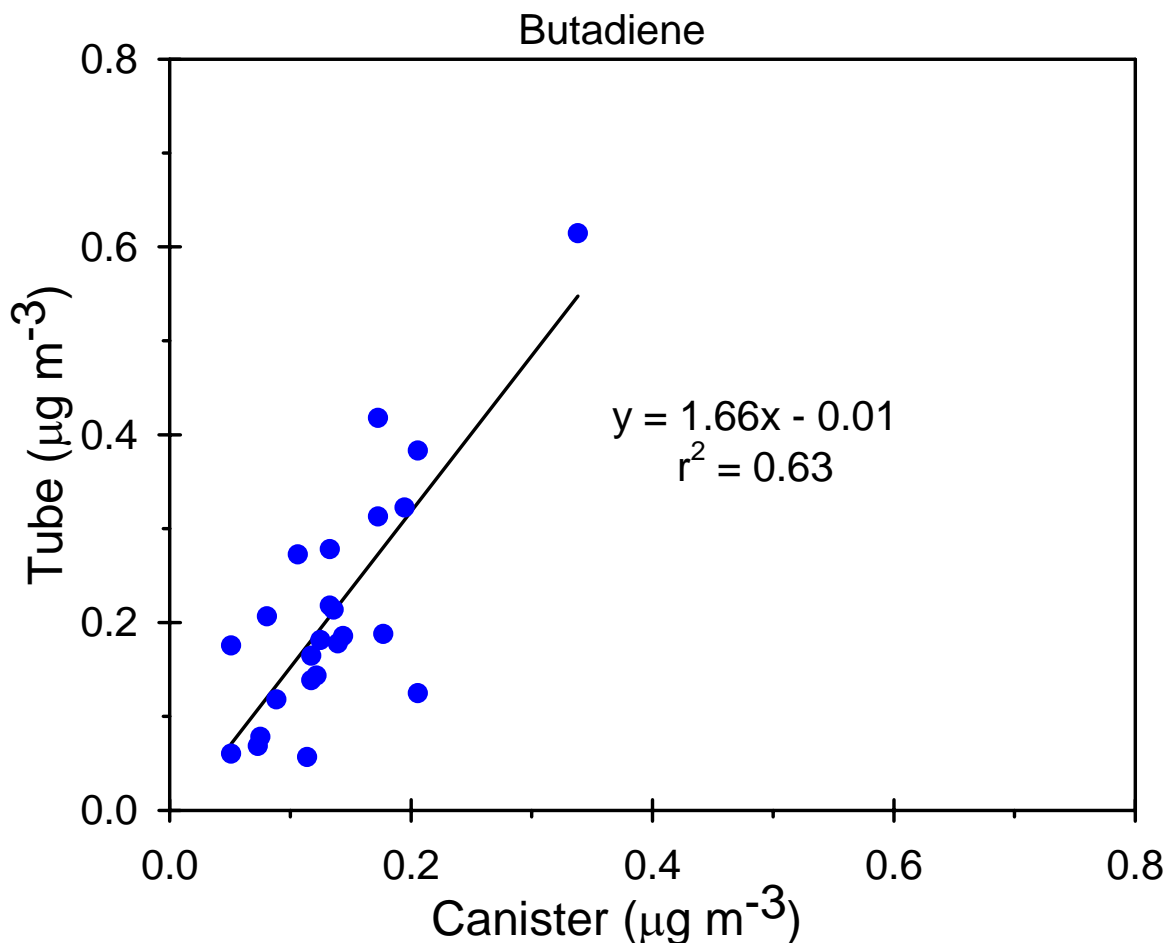


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Method Comparison

Tube and Canister



Preliminary results – Winter '06

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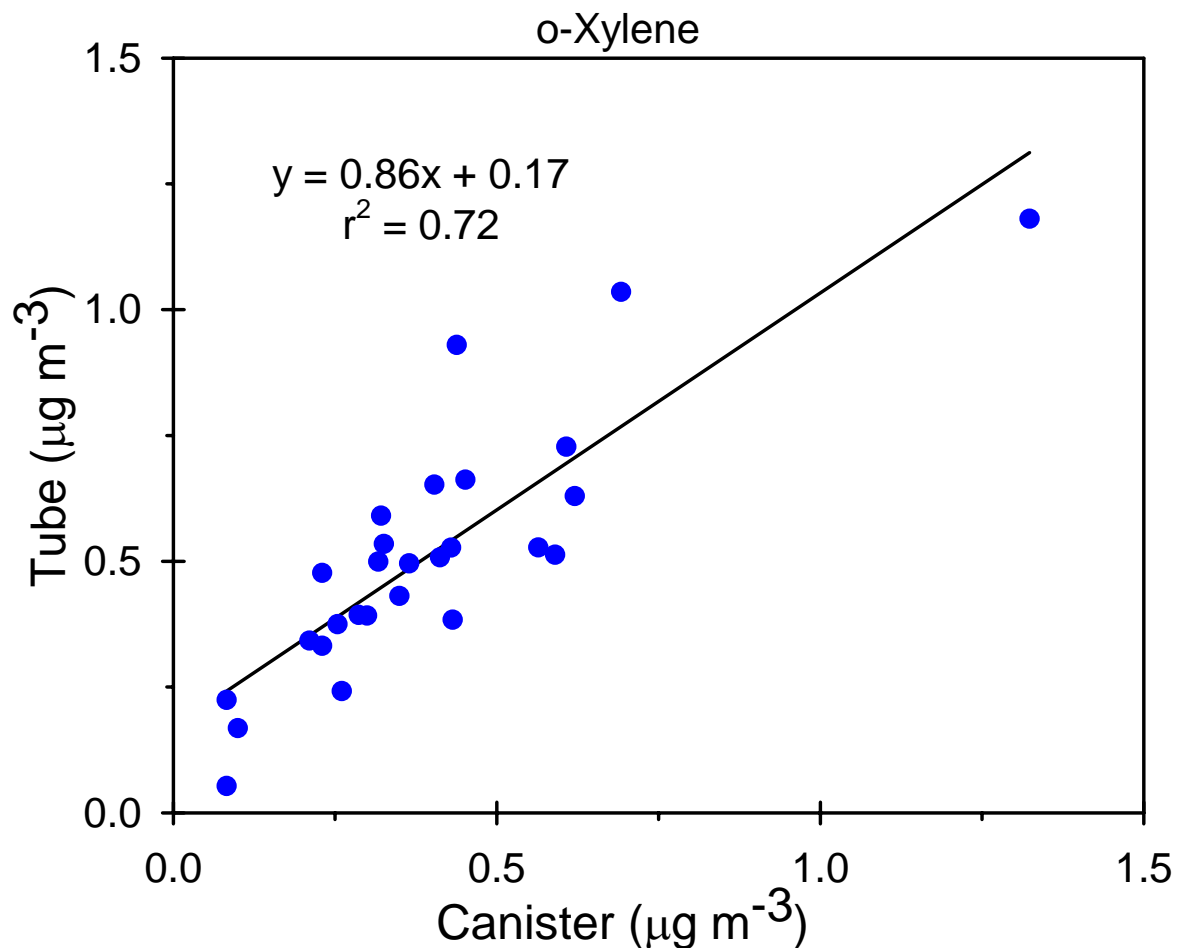


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Method Comparison

Tube and Canister



Preliminary results – Winter '06

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Method Comparison

Tube and Canister

Compound	Slope ^a	Intercept	r ²
Benzene	1.01 ± 0.13	-0.61 ± 0.20 ^a	0.69
Toluene	0.92 ± 0.11	-0.65 ± 0.33 ^b	0.73
Ethylbenzene	0.62 ± 0.11	0.31 ± 0.05 ^a	0.57
o-Xylene	0.86 ± 0.11	0.17 ± 0.05 ^a	0.72
m,p-Xylenes	0.84 ± 0.13	0.60 ± 0.17 ^a	0.61
1,3-Butadiene	1.66 ± 0.27	-0.01 ± 0.04 ^c	0.63

^a p<0.01

^b p<0.1

^c Not significant (p >> 0.10)

Preliminary results – Winter ‘06

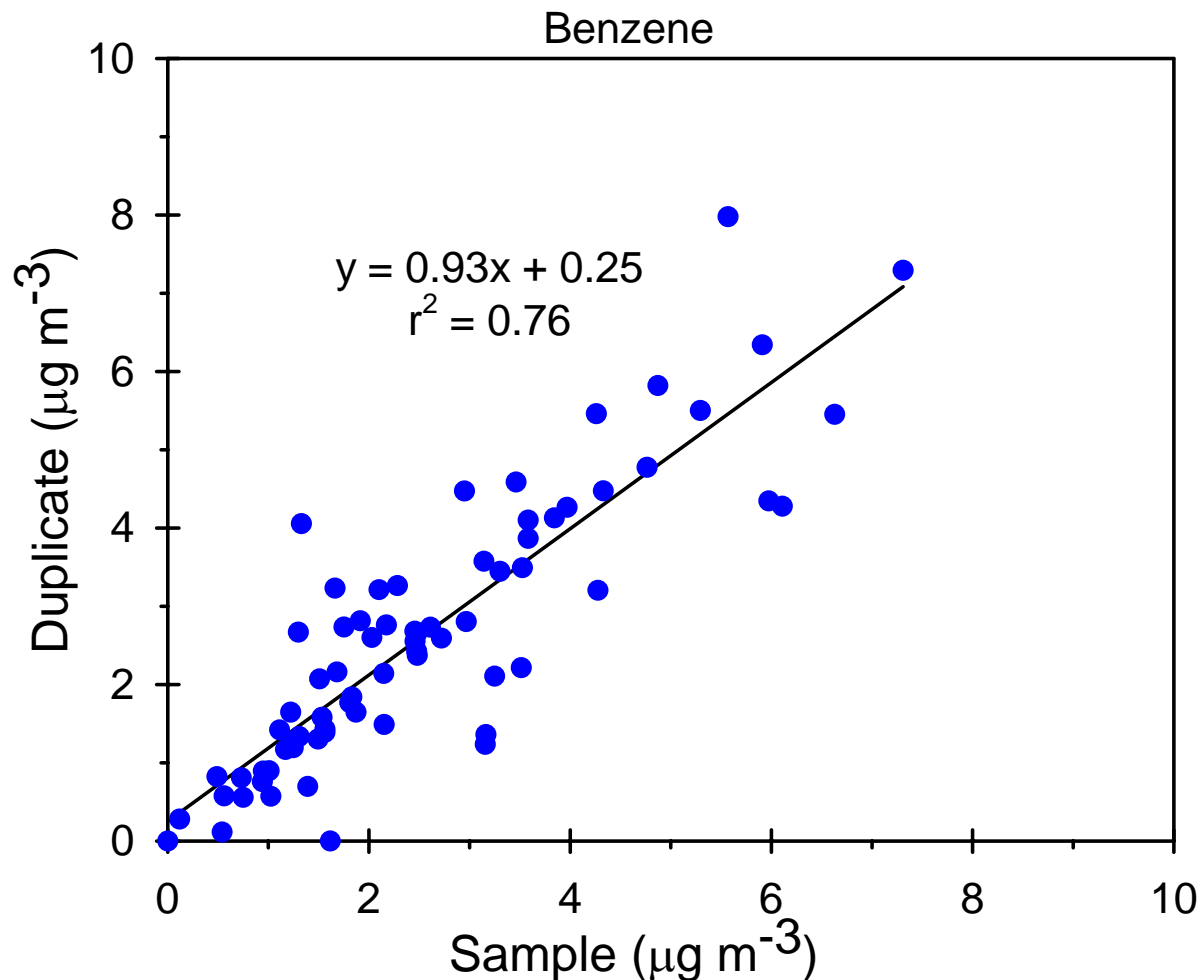
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Duplicate Tube Samples Outdoor and Ambient



Preliminary results – Summer '04 – Winter '06

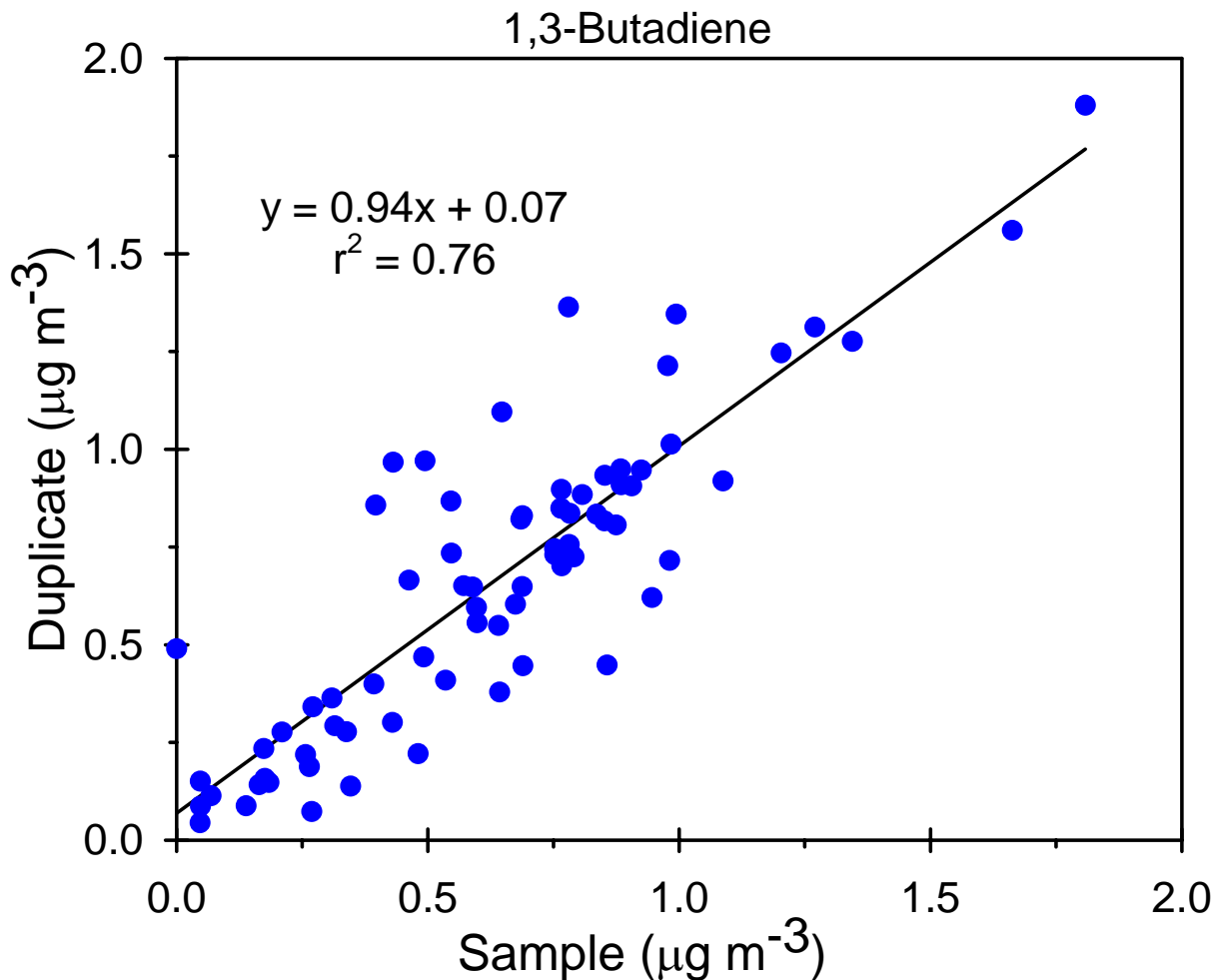
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Duplicate Tube Samples Outdoor and Ambient



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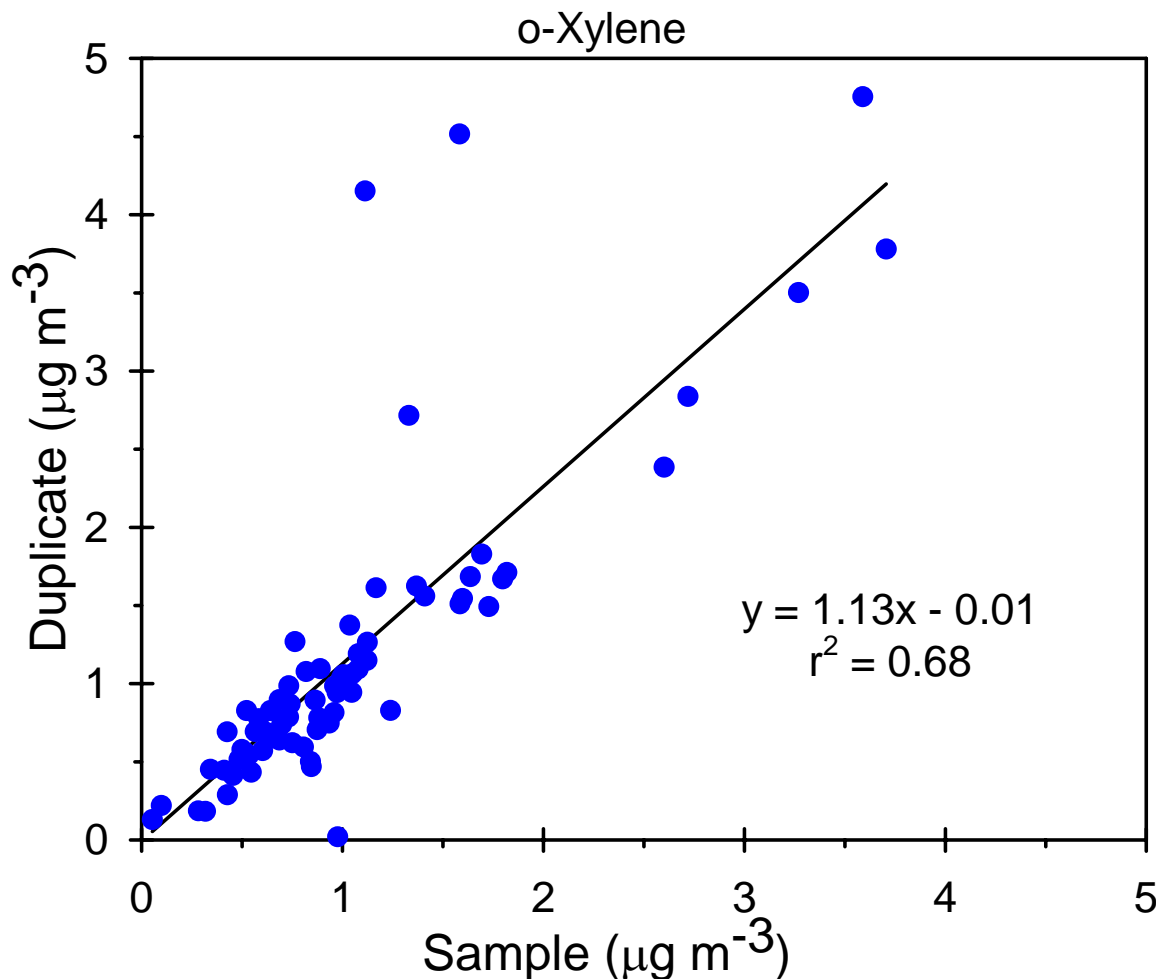
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Duplicate Samples Outdoor and Ambient

Compound	Slope ^a	Intercept ^b	r ²
Benzene	0.93 ± 0.06	0.25 ± 0.19	0.76
Toluene	0.93 ± 0.05	0.45 ± 0.31	0.84
Ethylbenzene	1.10 ± 0.09	-0.01 ± 0.11	0.68
o-Xylene	1.13 ± 0.09	-0.01 ± 0.12	0.68
m,p-Xylenes	1.15 ± 0.11	-0.04 ± 0.43	0.68
1,3-Butadiene	0.94 ± 0.06	0.07 ± 0.05	0.76

^a p<0.001

^b Not significant (p >> 0.10)

Preliminary results – Summer '04 – Winter '06

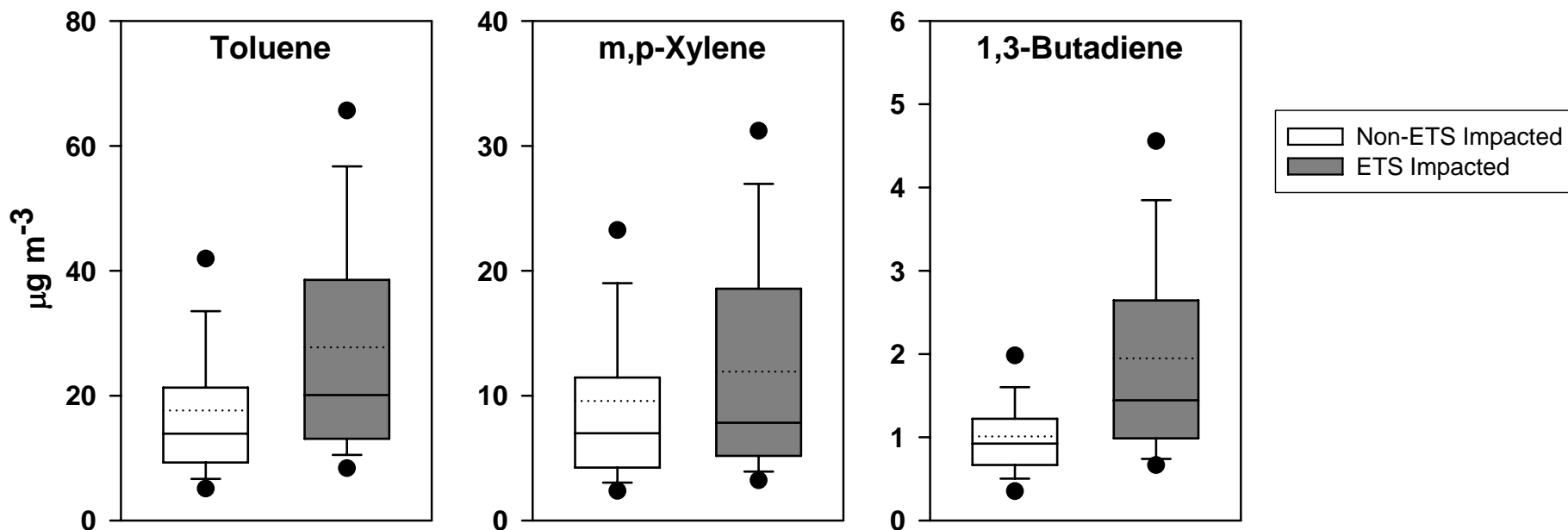
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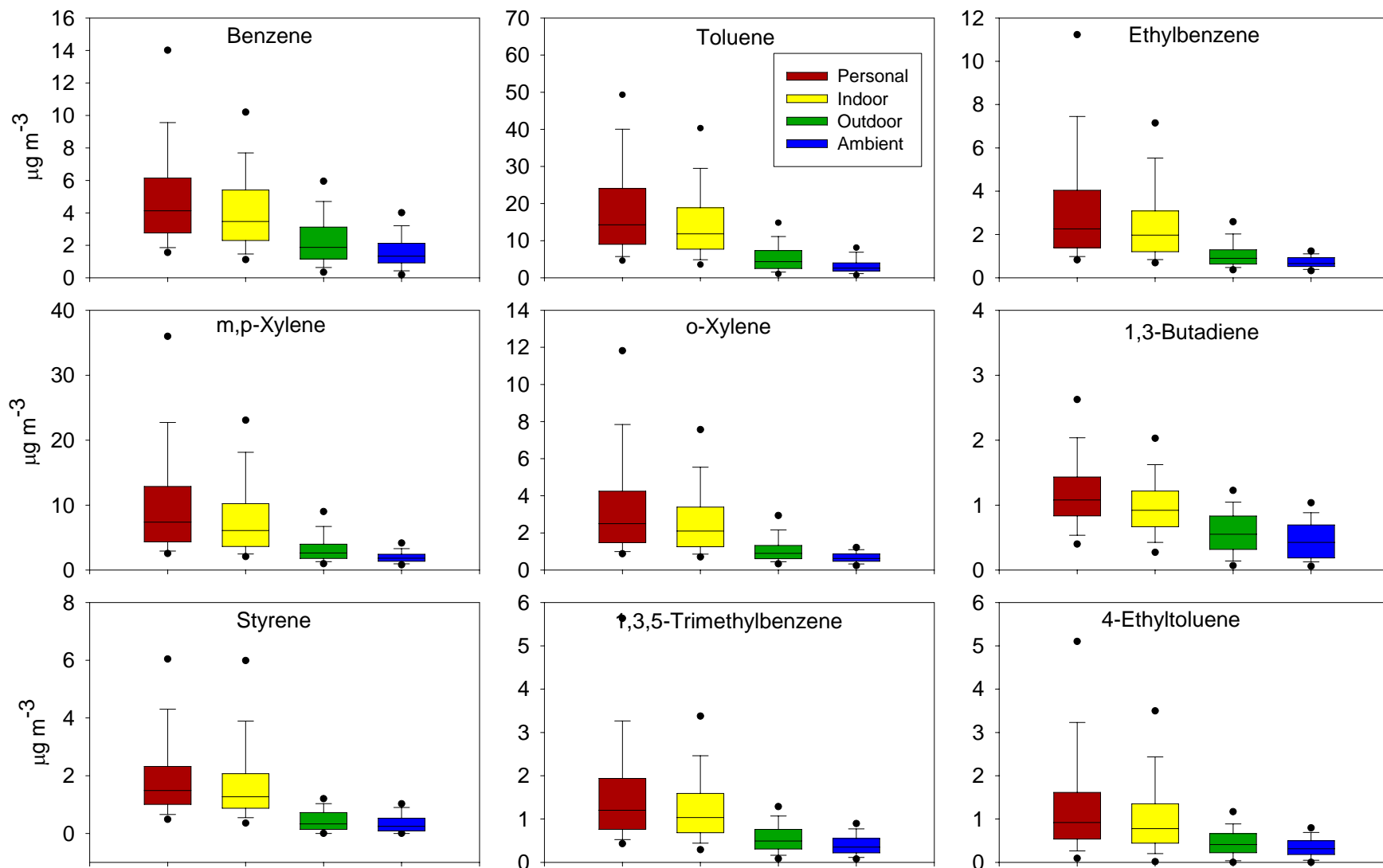
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Impact of ETS



- Indoor levels of VOCs associated with tobacco smoke
- ETS was measured using an optical technique on filter samples
- Samples were considered impacted by ETS when ETS levels exceeded $1.5 \mu\text{g m}^{-3}$



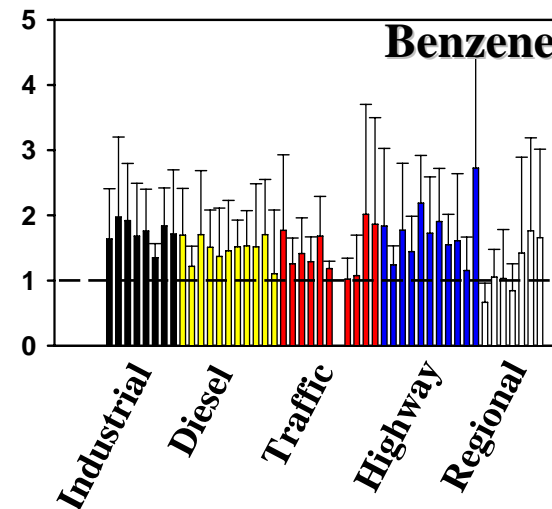
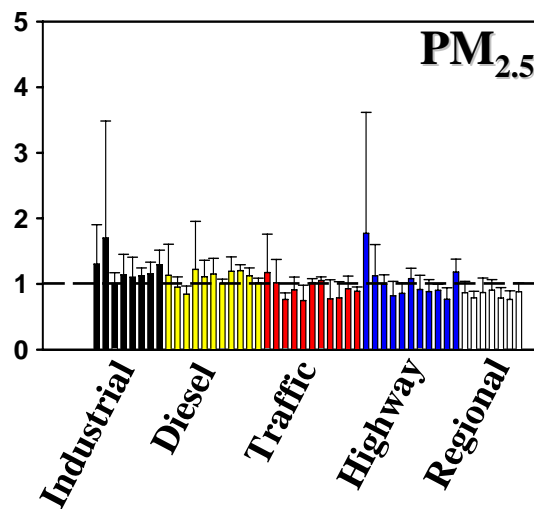
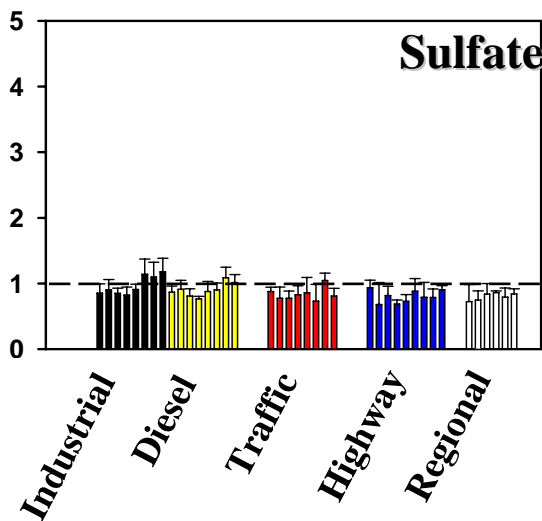
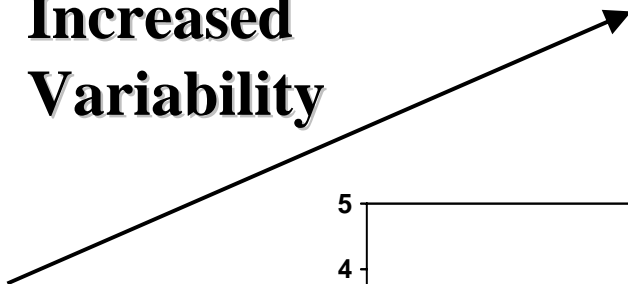
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Concentration Ratios

Outdoor Residential to Ambient Site

Increased
Variability



Preliminary results – Summer '04 – Summer '05

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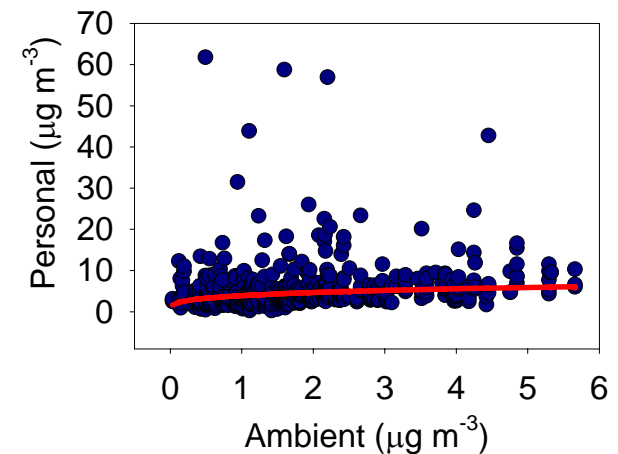
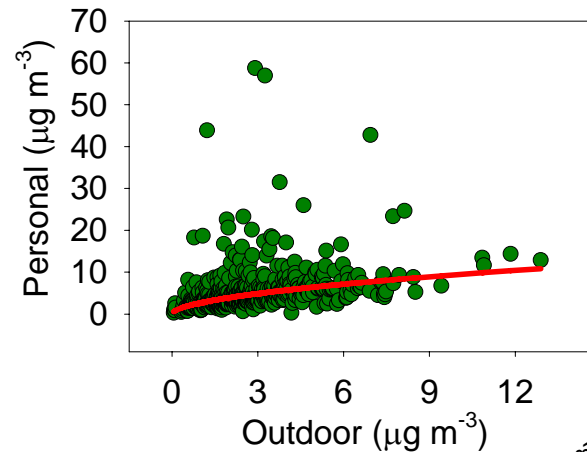
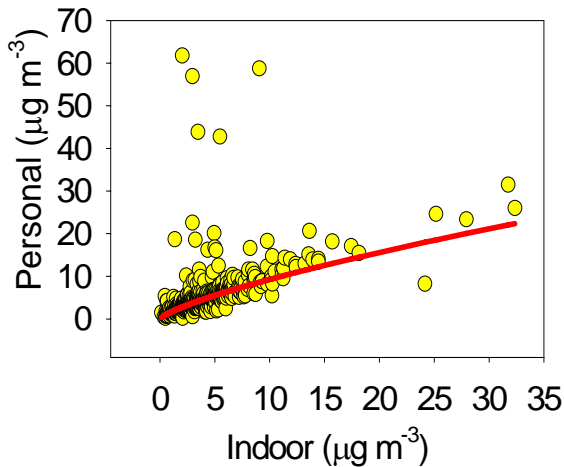


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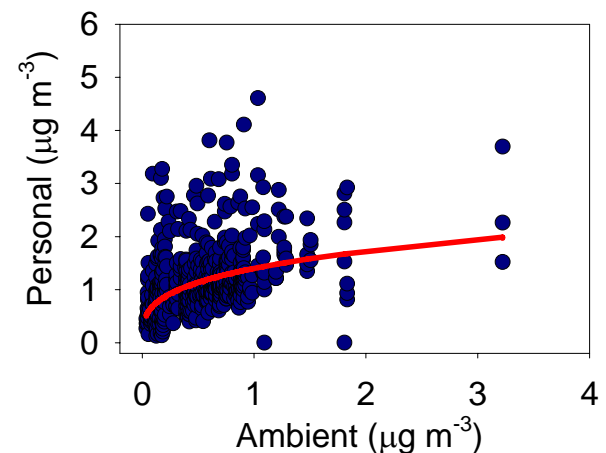
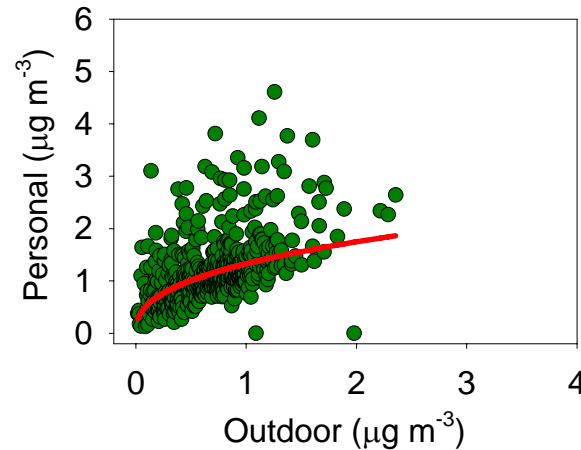
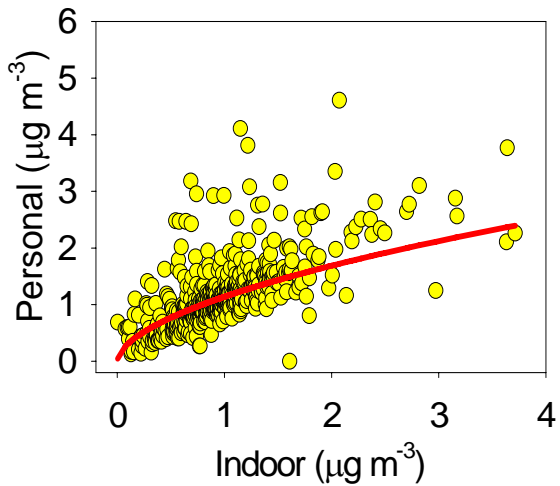
Personal Exposure Relationships

Benzene



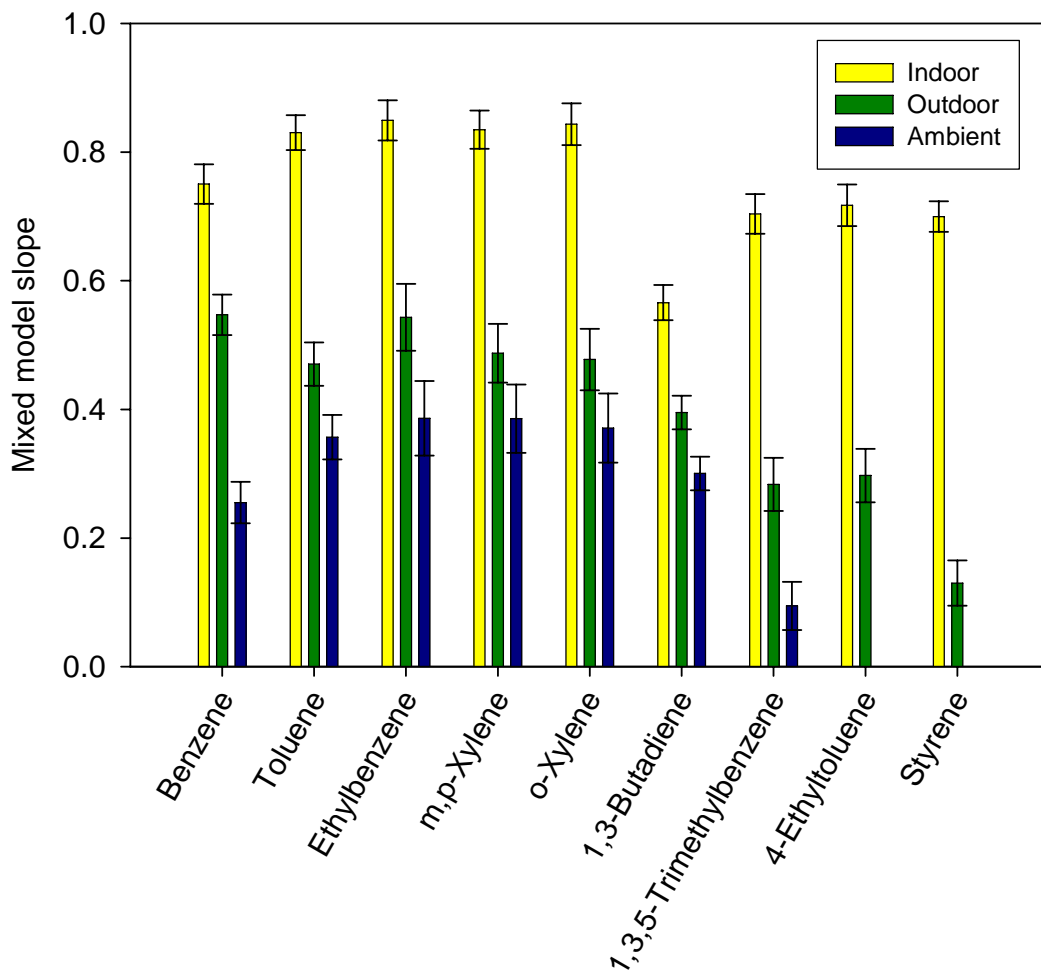
Personal Exposure Relationships

1,3-Butadiene



Personal Exposure Relationships

Log Transformed Data



- Mixed models – account for repeated measures
- Exposures related to indoor, outdoor and sometimes ambient
- Slopes (agreement): $I > O > A$

Conclusions

- Carbopack-X passive tubes – robust method to measure VOCs
- Second hand smoke found in 16% of indoor air and 22% of personal exposure samples
- Significant spatial and temporal variability in MSATs
 - Impact of sources (EMA) and locations (I, O, A)
- Personal exposures to MSATs
 - Indoor > Outdoor > Ambient
 - Concentrations and relationships

Disclaimer

Although this work was reviewed by EPA and approved for publication, it may not necessarily reflect official Agency policy.

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